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though it is hoped that an increase in the time may be successfully made at some future day. There is needed a better understanding of the laws which underlie atmospheric changes, so that empirical generalizations may give way to scientific deductions.

### EARTHQUAKES IN THE UNITED STATES AND CANADA.

*"Some say, the earth  
Was feverous, and did shake."*

SHAKESPEARE.

THE part of the earth's surface occupied by the United States is not generally regarded as much affected by earthquakes. As compared with some other localities, this is true; yet records show that moderate earthquakes are not so infrequent here as is usually supposed.

In the twelve years from 1872 to 1883 inclusive, three hundred and sixty-four earthquakes have been recorded as occurring in Canada and the United States, not including Alaska. Their geographical distribution may be expressed in this way. Suppose the country divided into three districts,—one extending from the Pacific Ocean eastward, to include Idaho, Utah, and Arizona, which may be called the Pacific slope; the second extending from Montana, Wyoming, Colorado, and New Mexico eastward, to include Ohio, Kentucky, Tennessee, and Alabama, which may be called the Mississippi valley; and the third, or Atlantic slope, extending eastward again to the Atlantic Ocean, and including the Appalachian region from the St. Lawrence to Florida and Georgia. Then the distribution of these three hundred and sixty-four earthquakes has been

|                              |       |
|------------------------------|-------|
| Pacific slope . . . . .      | 151   |
| Mississippi valley . . . . . | 66    |
| Atlantic slope . . . . .     | 147   |
|                              | <hr/> |
|                              | 364   |

These numbers indicate that about once in twelve days an earthquake occurs *somewhere* in the United States or Canada, and about once a month one occurs somewhere on the Atlantic slope.

It is quite likely, also, that for every earthquake which is of sufficient intensity to get itself noted in the midst of our busy American life, several lighter tremors may have occurred, which, although not violent enough to attract the attention of any one, would yet have left their record on a properly constructed seismoscope.

So, if any of our readers feel disposed to set up a seismoscope, they need not be deterred by the paucity of shocks in our country. A seismoscope anywhere along our eastern seaboard, or, still better, on the western coast, might fairly be expected to record ten or a dozen shocks in the course of the year, and might detect a much larger number. Such observations would be of high scientific value.

### TEMPERATURE AND ITS CHANGES IN THE UNITED STATES.

*"For hot, cold, moist, and dry, four champions fierce  
Strive here for mastery."*

MILTON.

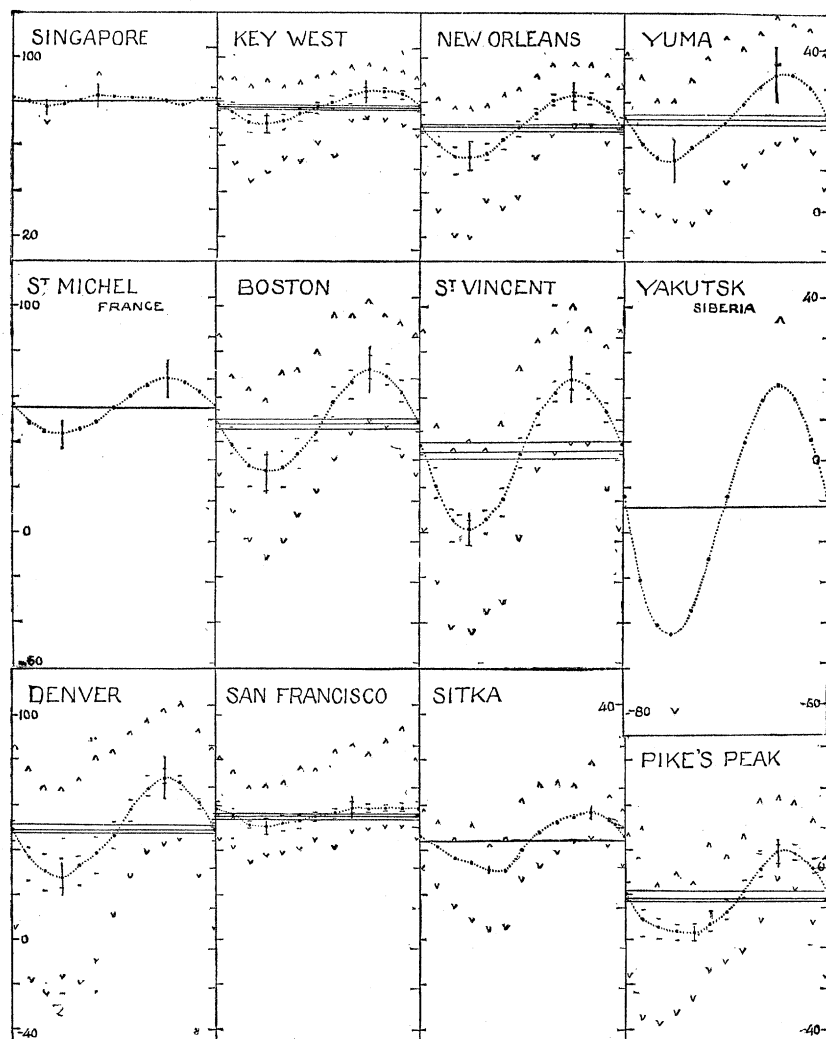
IN the United States the changes of temperature with the seasons are of several types. These are illustrated in the accompanying diagrams, constructed chiefly from our signal-service reports; the thermometric scale being indicated by marks for every twenty degrees Fahrenheit on the left, and for every ten degrees Centigrade on the right, of each local division. The middle horizontal line shows the measure of that arithmetical abstraction commonly known as the mean annual temperature; and the adjoining lines above and below indicate how much variation there may be in the means of different years. In this respect, St. Vincent, Minn., has a much more irregular climate than Key West. The dots connected by a fine, dotted, curved line, represent the mean monthly temperature, beginning with October on the left side, descending to the January minimum, crossing the mean annual line about April, on the way to the July maximum, and descending again to October on the right margin. In illustration of the least annual variation, a curve is introduced for the equatorial station of Singapore, at the extremity of the Malay Peninsula, where the mean annual change is only seven degrees (F.); and, in contrast with this torrid uniformity, we find Yakutsk, Siberia, in the so-called temperate zone, giving the greatest known annual variation, on account of being far north, and far within a great continental region. St. Vincent, the coldest of the signal-service stations, is probably our nearest approach to this extreme variability.

The irregularity of the monthly means in different years is shown by short transverse lines above and below the dots: these are farther apart in winter than in summer, on account of the frequency of winter storms which produce great and sudden

changes of temperature.<sup>1</sup> A rough measure of the average daily range for summer and winter is seen in the vertical lines drawn through the July and January dots: these are commonly longer in summer than in winter. The hottest and coldest records for every month are marked by A and V.

curve than the winter colds fall below it, while the reverse is the case with New Orleans. The extreme variation between winter minimum and summer maximum, even of different years, is only 23° F. at Singapore: our least variable station is Key West, with a maximum change of 53° F. Yuma,

Arizona, although well known as often excessively hot, confines its variations within 93°; Denver has a recorded change of 134° from 105° to -29°; while Fort Benton, Montana, leads the list with a change of 167°, between 108° and -59°, but even this is exceeded at Yakutsk. The contrast between eastern and western coasts is seen in the variability of Boston as compared with St. Michel, on the coast of France in about the same latitude, the latter being warmer and less variable because it lies to the leeward of a temperate ocean, while Boston is to leeward of an untempered land; and again in comparing Boston (in latitude 42° 21') with Sitka (in latitude 57° 3'), and recognizing the small difference in their mean temperatures, and the decided decrease in



Denver is thus seen to be warmer but more variable than Pike's Peak. In San Francisco the summer heat extremes rise higher above the mean

variability, annual and diurnal, in going from the east coast to the west. The effect of going inland is to increase changes of temperature; for, while the sea is conservative of its warmth or cold, the land allows great and rapid variations. If the climatic zones had been first named in this country, ours would never have been called the 'temperate.'

<sup>1</sup> The variation of monthly means for Boston is large, in comparison with that of the other diagrams, partly because it is taken from a thirty-five year record instead of from the eleven or fewer years of the signal-service reports.